SPECIFICATION

1. Title of the Invention

Water-cooled Explosion Tube

2. Claims

(1) A water-cooled explosion tube characterized in that an inner tube having one end closed is inserted into an outer tube having one end closed, an air gap formed between the inner and outer tubes is a water-tight structure, a water supplying pipe having one end opened is inserted from its other end into the air gap, a drain is provided at said other end, and explosive is set in the inner tube.

3. Detailed Description of the Invention

[Industrial Field of Utilization]

The present invention relates to an explosion tube used in a blasting operation at a high-temperature place and more particularly, used optimally in a blasting operation at the time of renovation of a blast furnace.

[Prior Art and Problems that the Invention is to solve]

Conventionally, in operation of a blast furnace, as a result of continuous operations thereof, since carbon, powder ore, metal and the like are firmly fixed to its inside, a regular renovating operation is necessary. At the time of the renovation, an operation for removing the above fixed material by blasting is performed during its demolition work.

Since this blasting operation is performed under a high

temperature, explosive has to be set at a predetermined position while it is always cooled down. Thus, conventionally, a water-cooled explosion tube, which will be described later, is used. More specifically, as shown in Fig. 2, an inner tube (5') having one end whose upper side is opened and other end connected to a water supplying pipe (6) is inserted into an outer tube (3') having one end closed and a cartridge (10) filled with explosive (9) is set in the inner tube (5'), or as shown in Fig. 3, explosive (9) is inserted by an auxiliary rod (12) from its open end into a single tube (11) having one end closed to its edge portion and the open end is blocked with a cloth plug (14) to which a water hose (13) is attached. In addition, reference numeral (15) in the figure designates a detonator wire.

However, according to the former explosion tube, since it is a three-layer structure comprising the outer tube, the inner tube and the cartridge, an amount of explosive to be filled is small. In addition, since the discharging system is opened, when it is set at a high-temperature place, a large amount of vapor is generated or water does not sufficiently circulate around the whole air gap between the outer and inner tubes, which are problems. Furthermore, according to the latter explosion tube, since it is a single-tube structure, it is inexpensive. However, the explosive is directly in contact with the tube. In addition, since the water discharging system

is also opened, as described above, the vapor is generated, a large amount of water is necessary to circulate around the whole tube and the temperature cannot be controlled, which are also problems.

[Means for Solving the Problems]

The present invention was made in view of the above problems to improve the conventional water-cooled explosion tube after various kinds of studies.

More specifically, the present invention is characterized in that an inner tube having one end closed is inserted into an outer tube having one end closed, an air gap formed between the inner and outer tubes is made to be water-tight structure, a water supplying pipe having one open end is inserted from the other end into the air gap, a drain is provided at the other end, and explosive is set in the inner tube.

[Embodiment]

An embodiment of the present invention will be described.

As shown in Fig. 1 (a) and Fig.1 (b), into an outer tube (3) whose one end is closed, the other end is provided with two drains (1) connected to the inside and a flange (2) is attached to the other open end, an inner tube (5) whose one end is closed and a companion flange (4) with the flange (2) is attached to the other open end is inserted, and both of the flanges (2) and (4) are bolted through an O ring. Two water supplying pipes

(6) penetrating the companion flange (4), extending up to the one end and being opened at their ends, are fixed to an outer surface of the inner tube (5). Explosive is inserted from the open end to the inside of the inner tube (5) to constitute a water-cooled explosion tube. In addition, reference numeral (7) designates a ribband of the inner tube (5). If the ribband (7) is fixed to the outer surface of the inner tube in the position perpendicular to the water-supplying pipe (6), the water-supplying pipe (6) also prevents slippage of the inner tuber (5).

The water-cooled explosion tube is set at a predetermined place and used in the state where it supplies water from the water supplying pipes (6) and discharges the water from the drains (1).

The water-cooled explosion tube is characterized in that an air gap (8) formed between the inner and outer tubes is of a watertight structure except for the water supplying tubes (6) and the drains (1).

Therefore, according to such an explosion tube, since water is collected by the drains, vapor is prevented from generating in a high-temperature environment. Furthermore, the water supplied from the water supplying pipes can sufficiently circulate around the whole air gap (8). In addition, since it is a double layer system, an amount of explosive filled in the inner tube is largely increased as

compared with the conventional three-layer structure. Still further, a temperature can be surely controlled by measuring temperatures of the discharged water and the inner tube, and the temperature can be adjusted by controlling the amount of the supplying water. In addition, an amount of water used is the least as compared with the conventional explosion tube.

Besides, although there are two water-supplying tubes (6) in the above embodiment of the present invention, one tube may be provided. In addition, the drain (1) may be provided only at an upper portion.

[Effects of the Invention]

Thus, according to the present invention, as compared with a conventional case, there can be provided several effects in practice, for example, since there is no vapor generation, a working operation is safe, the temperature is adjustable and the water consumption is small.

4 Brief Descriptions of the Drawings

Fig. 1 (a) and Fig.1 (b) illustrate an embodiment of the present invention, in which Fig. 1(a) is a side sectional view showing a substantial part and Fig. 1(b) is a front view thereof, and Figs. 2 and 3 are side sectional views showing the conventional examples.

1: Drain

2: Flange

3: Outer tube

4: Companion flange

5: Inner tube

6: Water supplying pipe

7: Ribband

8: Air gap

9: Explosive

10: Cartridge

11: Single tube

12: Auxiliary rod